CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Method and Research Design

The research method which was used in this research is quasi experiment method. This is related to the purpose of the research which is to investigate the effect of Conceptual Change Text towards students' understanding and argumentation skill in learning sound. According to Creswell (2012) quasi experiment provides the researcher which the opportunity to assess the effects of interventions or treatments. By applying this method, there were two groups which are control and experimental group.

Consider that the number of class that was used in this research are two classes, there were control group and experiment group. The research design that used in this research is pre-test and post-test design (Creswell, 2012). The researcher assigns intact groups the experimental and control treatments, administers a pre-test to both groups, conducts experimental treatment activities with the experimental group only, and then administers a post-test to assess the differences between the two groups. The learning model that used in both classes is demonstration method which included teacher explanation and examples, the differences only in teaching materials. In experiment group learn with Conceptual Change Text, while control group learn with conventional book which is used in school. It can be shown on Table 3.1.

Table 3.1 Pre-test and Post-test Design

Select Control Group	Pre-test	Conventional Book	Post-test
Select Experimental Group	Pre-test	Conceptual Change Text	Post-test

(Creswell, 2012)

3.2 Population and Sample

The location of this research is at one of International Junior High School in Bandung. The population of this research was 8th grade students. The class of this school is conducted in English as instructional language. The curriculum which is implemented in this school is Cambridge Curriculum.

The sample was taken by cluster random sampling technique. According to Freankel, Wallen, & Hyun (2011) stated that cluster random sampling is defined where one is obtained by using groups as the sampling unit rather than individuals. The consideration is because once a cluster is selected. All the members of the cluster must be included in the sample. They also stated that cluster random sampling is more effective with larger number of cluster and this sampling technique is appropriate with the quasi experiment method. Table 3.2 is the recapitulation of the sample.

Table 3.2 Data of the Sample

Group	Population	Sample		Percentage (%)	Total (%)
Control	8th grade	Male	9	42.86	100
		Female	12	57.14	
Experiment	8th grade	Male	8	38.10	100
		Female	13	61.90	

The population for the research consisted of a total 42 eight grade students (25 female, 17 male). One control group (with 21 students, 12 female, 9 male, with an average age of 13-14) and one experimental group (with 21 students, 13 female, 8 male, with an average age of 13-14) were involved in the research. Students in both group come from similar educational and socio-economic backgrounds.

3.3 Research Instrument

In this research, instrument is necessary to be used for gaining data. There were three type instrument that were used in this research which are objective test, argumentation rubric, and observation sheet. Those instruments are described below:

3.3.1 Objective Test

Multiple choice questions in this research instruments used to measure students' understanding including remembering (C1), understanding (C2), applying C3), analyzing (C4) based on A Revision of Bloom's Taxonomy. The multiple choice questions include 23 questions. The questions given as pretest and posttest after both group get treatment with test-measuring technique.

3.3.2 Argumentation Rubric

The rubric used is the argumentation writing essay which is adapted from the journal created by Toulmin, Rieke, & Janik (1984). The rubric used to evaluate students' argumentation skill which includes four aspects of argumentation which are: *Claim*, *Data*, *Warrant,* and *Backing.* The criteria for every score given are shown in the Table 3.2.

Table 3.3 Rubric for Assessing Quality of Argumentation in Student Essays

Quality	**Claim** **Criteria**
6	The writer states generalizations that are related to the proportion and which are clear and complete.
4	The writer states generalizations that are related to the propositions, but the assertions are not complete.
2	The writer makes generalizations that are related to the proposition, but the assertions lack specificity or offer unclear referents.
0	No claim related to the proposition or unclear assertions.

Quality	**Data** **Criteria**
6	The supporting data are complete, accurate, and relevant to the claim.
4	The data offered are relevant but not complete.
2	The data or evidences are weak, inaccurate, or incomplete.
0	No supporting data are offered or the data are not related to the claim.

Quality	Warrant Criteria
6	The writer explains the data in such a way that it is clear how the support the claim.
4	The writer explains the data in some way, but the explanation is not linked specifically to the claim.
2	The writer recognizes a need connect the data to the claim and states some elaboration of data, but the writer fails to make the connection.
0	No rules and principles are offered.

Quality	Backing Criteria
6	The writer states correct, relevant, and specific sources of warrants.
4	The writer states correct, relevant sources of warrants but the sources are very general not specific.
2	The writer states incorrect, irrelevant sources of warrants.
0	No sources or warrants are given.

(Toulmin, Rieke, & Janik 1984)

3.3.3 Observation sheet

Observation sheet was used by the observer to measure the teaching learning activities done by the researcher. The observation sheet gave the information about the percentage of activities done based on the lesson plan in both group. The observation sheet is shown in Appendix 2.5 page 139.

3.4 Instrument Validation Results

1) Validation of Objective Test

The objective test that used in this research is the kind of multiple choice questions. In this research the objective test should be validated first before used. The instruments were tested to measure its validity, reliability, discriminating power, and difficulty level. To get the data of instrument validation, a limited test need to be done. The test assigned to 22 students which have learned about sound concept. The limited test consist of 23 multiple questions. The data obtained from the limited test was analyzed by ANATEST 4.0 software. The content validation is mostly good and it has been analyzed from expert judgments. The reliability of

the test item is 0.59, which is included as enough. The recapitulation of objective test as well as specification for each question item is shown on Table 3.4

Table 3.4 Analysis of Test Item by ANATES

Number of Question	Discriminating Power	Level of Difficulty	Validity	Note
1	Moderate	Easy	Low	Used
2	Excellent	Medium	High	Used
3	Poor	Easy	Low	Revised
4	Poor	Difficult	Very Low	Revised
5	Good	Medium	High	Used
6	Excellent	Medium	Enough	Used
7	Excellent	Medium	Enough	used
8	Good	Easy	Enough	Used
9	Excellent	Medium	Enough	Used
10	Excellent	Medium	High	Used
11	Excellent	Easy	Enough	Used
12	Poor	Medium	Very Low	Revised
13	Moderate	Difficult	High	Used
14	Poor	Very Easy	Very Low	Revised
15	Excellent	Medium	Enough	Used
16	Moderate	Medium	High	Used
17	Good	Medium	Enough	Used
18	Good	Medium	Enough	Used
19	Poor	Medium	Very Low	Revised
20	Excellent	Easy	Very Low	Revised
21	Moderate	Medium	Enough	Used
22	Good	Difficult	High	Used
23	Excellent	Medium	Enough	Used

2) Validation of Written Argumentation Test

Students' argumentation skill was measured using essays argumentation test. There are four questions for argumentation test of sound concept which included in this research. Those are sound waves, properties of sound, sound reflection, and musical sound. Each subtopic has one question to measured students' argumentation skill. In order to get the data of instrument validation, a limited test need to be done. The content validation has been analyzed from expert judgments. The recapitulation of argumentation test for each question item is shown on Table 3.5

Table 3.5 Analysis of Argumentation Test

No	Topic	Question	Recommendation	Note
1	Sound waves	When we hit the tuning fork, then how is waveforms generated? Does the sound waves produced included into transverse wave or longitudinal wave?	Revise the question problem with: When we hit the tuning fork, then how is waveform generated? Is the sound wave produced including transverse wave or longitudinal wave?	Revised
2	Properties of sound	-	-	Used
3	Sound reflection	According to the picture above, which can reflect sound clearly?	Revise the question problem with: According to the picture above, which material can reflect sound clearly?	Revised
4	Musical sound	-	-	Used

3) Validation of Conceptual Change Text

In this research Conceptual Change Text consists of four concepts of sound those are sound waves, properties of sound, sound reflection, and musical sound. The two concepts of sound about properties of sound and musical sound are adopted from journal (Ozkan, 2013) while the rest concept about sound waves, and sound reflection are developed by the author, and has been judged with two validators declared after through several stages of revision. After revision, then the Conceptual Change Text with four concepts of sound was used in this research. The analysis of Conceptual Change Text shown on Table 3.6

Table 3.6 Analysis of Conceptual Change Text

Topic	Before Validation	Validated	Note
Sound Waves	• A vibrating object in air causes shifting of layers of air particles. By doing so, longitudinal sound	• A vibrating object in air causes shifting of layers of air particles. Therefore, longitudinal sound waves are	Revise

	waves are produced by the vibrating object. • On the next page, shows how longitudinal sound waves are produced by a vibrating tuning fork.	produced by vibrating an object. • On the next page, it will show how longitudinal sound waves are produced by a vibrating tuning fork.	
Properties of Sound	-	-	Used
Sound Reflection	• The applications of echoes include the measuring of large distances or the detection of the location objects (i.e. echolocation) that are not easily sighted. • The echo is heard by the bats which can then pinpoint the position of obstacles and thus avoid them.	• The applications of echo include the measuring of large distances or the detection of the object location (i.e. echolocation) that is not easily sighted. • The echo is heard by the bats which can be obtained from pinpoint the position of obstacles and thus avoid them.	Revise
Musical Sound	-	-	Used

3.5 Research Procedure

First Stage

The steps are including the following activities below:

1) Literature review conducted to analyze the information about Conceptual Change Text, students' understanding, students' argumentation skills, and sound concept.
2) Arrangement of instruments including objective test, rubric to measure students' argumentation skills, and observation sheet instructional tools will be used are lesson plan and worksheet that arranged to support the implementation of this research.
3) Judgment of instruments will be conducted by experts.

4) Trial test of objective test instrument will be conducted to identify the quality of instrument.
5) Revision of instruments will be done based on judgment result and test item analysis.

Implementation Stage

These activities below will be conducted in the implementation stage which consists of three main activities. The activities are:

1) Determination of control and experimental group.
2) Pretest was given to the students in control and experimental group to identify students' prior knowledge and students' initial condition.
3) Conduct research activity by implementing the treatment in experimental group which learn with Conceptual Change Text about sound concept.
4) Conduct research activity by implementing the treatment in control group which learn with conventional book about sound concept.
5) Assessing students' argumentation writing test.
6) Posttest was given to the students in control and experimental group to know the improvement of students' understanding.

Completion Stage

Completion stage consists of four stages, which are:

1) All of data will be obtained then calculated.
2) The result of data calculation will be analyzed.
3) Discuss and conclude the data analysis result.
4) Arrange the research report.

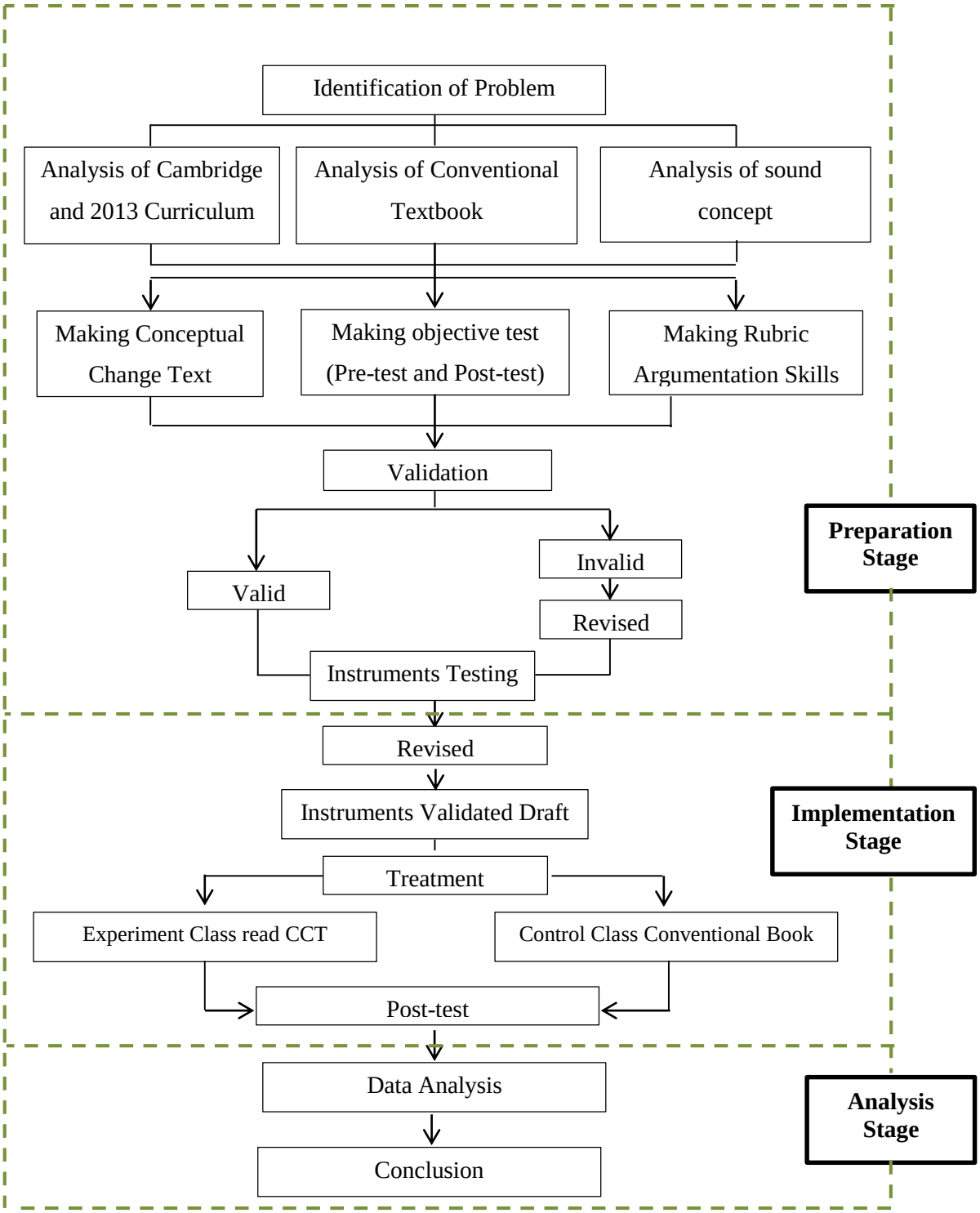

Figure 3.1 Flowchart of Research Procedure

3.6 Data analysis

3.6.1 Assumption

The assumption as the foundation of this study as follow:

1) Conceptual Change Texts specify students' misconceptions, clarify their reasons, and explain why they are incorrect by using concrete examples (Guzetti, Williams, & Wu, 1997).
2) Conceptual Change Text is such an effective teaching strategy that it can be used throughout the teaching-learning process mainly because of its practical aspects (Ozkan and Selcuk, 2013).
3) Conceptual Change Texts are designed to make students aware of their inaccurate pre-conceptions and help them change their non-scientific conceptions toward more scientific ones through the use of explanations and examples (Hynd et al., 1994).

3.6.2 Hypothesis Test

The hypothesis in this research tested using SPSS 17.0 program. Before determining which kind of hypothesis test that will be used, the test of normality should be done. If the data is normally distributed, the test of hypothesis which is used parametric test. If not, the test of hypothesis is used non-parametric test.

The hypothesis test of differentiation is used to see whether there is difference in control group and experiment group after treated. The hypothesis which is tested is shown as follow:

H_0: There is no difference in students' understanding on learning sound after using Conceptual Change Text

H_1: There is difference in students' understanding on learning sound after using Conceptual Change Text

H_0: There is no difference in students' argumentation skill on learning sound after using Conceptual Change Text

H_1: There is difference in students' argumentation skill on learning sound after using Conceptual Change Text

3.6.3 Analysis of Students' Understanding

The analysis to of students' understanding was process using Microsoft Excel calculation to determine the score of pretest and posttest. The value of quantitative data is gained by the result of Normalized Gain (N-Gain). The calculating process of data is explained as follow:

1) Score of Test Item

In this research, the improvement of students' understanding is measured using the data of test scores. The 23 test item is used in this research to test the students' understanding. Each items are given 1 score for the correct answer and 0 score for incorrect answer.

2) Normality Test

Normality test aims to know the sample which comes from population has normal distribution or not. The use of parametric statistic has a deal with assumption that each analyzed variable in this is a normal distribution. The homogeneity test cannot be done if the data is abnormal or the parametric technique cannot be used. Meanwhile if the data is normal and homogeneous, the parametric technique can be used.

In this research, the normality test on the control group and the experiment group conducted separately and it is done by using SPSS 17.0 program. *Kolmogorov-Smirnov* and *Shapiro-Wilk* with significance level (α) is 0.05. The statistic criteria as if significance value more than 0.05, hence H_0 is accepted and if significance value less than 0.05, then H_0 is rejected or denied (Cunningham and Aldrich, 2012). The hypotheses are:

H_o: Sample comes from population that has normal distribution

H_1: Sample comes from population that has not normal distribution

3) Homogeneity Test

A sample from population that is originated from two classes that homogeneous can be determining using homogeneity test. In this research, the homogeneity test is used only in experiment group because in control group the data is abnormal, so no need to check homogeneity test. To analyze the homogeneity test is also used SPSS 17.0 program, which significance level (α) is 0.05. Sudjana (2005) stated that the data is homogeneous when significance value ≥ 0.05.

4) Independent T-Test and Mann-Whitney Test

Independent t-test can be used when the data comes from normal and homogeneous. Because in this research both groups are in normal and abnormal, continue with nonparametric test which is Mann-Whitney test will be used in this research. This test is represented by the result of pretest and posttest score in control and experiment group. The test is using Mann-Whitney in SPSS 17.0 program. According to Sudjana (2005) stated that H_0 is rejected if the level of significance ≤ 0.05 while H_0 is retained if the level of significance ≥ 0.05.

5) Calculation of Gain Score and Normalized Gain

The data of the pretest and posttest score are needed to be processed by calculating the gain score and normalized score. Gain is needed to be calculated to determine the differences between pretest and posttest score to know the improvement of learning and it can be seen clearly. It could be assumed as the effect of the treatment. After the actual gain is gotten, then Normalized Gain (N-Gain) can be gotten. Normalized Gain calculations are supposed to determine the categories of the achievement of students' improvement. According to Hake (1999), Gain could be computed use the equation below:

$$G = S_f - S_i$$

Description:

G : Gain score

S_f : Posttest score

S_i : Pretest score

(Hake, 1999)

The effectiveness of the treatment in teach sound concept to increase students' understanding could be seen from the result of the Normalized Gain (N-Gain) that achieved by students during the learning process. The meaningful improvement can be shown from normalized gain rather than actual gain because the improvement of higher and lower achiever students can be shown clearly. Based on Hake (1999), the Normalized Gain could be computed using the equation below:

$$< g > = \frac{(average\ of\ posttest\ score) - (average\ of\ pretest\ score)}{maximum\ score - (average\ of\ pretest\ score)}$$

Then the Normalized Gain value is determined based on criteria below shown in Table 3.7

Table 3.7 Criteria of Normalized Gain

<g>	Criteria
$<g> \geq 0.7$	High
$0.3 \leq <g> < 0.7$	Medium
$<g> < 0.3$	Low

(Hake, 1999)

3.6.4 Analysis of Students' Argumentation Skill

Students' argumentation skill was scored based on the rubrics. There are four aspects that are used to measure the score of students' argumentation skill. Each aspect has four scales which is adapted from Toulmin, Rieke, &

Janik (1984). The quantitative data was process using Microsoft Excel calculation to determine the score of pretest and posttest, to get the value of quantitative data is gained by calculation the result of normalized gain. The steps of calculating data were tested to measure its normality, homogeneity, and independent T-test.

3.6.5 Analysis of Correlation between Students' Understanding and Argumentation Skill in Learning Sound

The analysis of correlation aims to compare two variables between students' understanding and argumentation skill on experiment group and control group. According to Cunningham & Aldrich (2012) Correlation coefficient that indicates the degree to which two variables are related and whether any detected relationship is positive or negative. The interpretation of correlation coefficient is shown on Table 3.8

Table 3.8 Interpretation of Correlation Coefficient

Correlation	Interpretation
0.0 – 0.19	Very Low
0.20 – 0.39	Low
0.40 – 0.59	Medium
0.60 – 0.79	Strong
0.80 – 1.00	Very Strong

(Sugiyono, 2008)

3.7 Operational Definition

In order to avoid misconception about this research, so some operational definitions are explained in this research. Those terminologies are explained as follow:

1. Conceptual Change Text is a teaching material based on conceptual change approach (Sahin & Cepni, 2011). Posner et al., (1982) stated that there are four conditions to provide conceptual change, which are: *Dissatisfaction, Plausibility, Intelligibility,* and *Fruitfulness*. The learning process is conducted based on lesson plan, and is checked by observation sheet.

2. Students' understanding that is measured in this research is the competences of students that covers the level cognitive of remembering (C1), understanding (C2), applying (C3), analyzing (C4). This competence is measured by using multiple choice questions in pre-test and post-test as the objective test.
3. Students' argumentation skill that is measured in this research is measured by four essay question related to the sound concept which includes four aspects of argumentation, which are: *Claim, Data, Warrant,* and *Backing* which is measured using rubric argumentation proposed by Toulmin, Rieke, & Janik (1984).